

CHROMOSOME COUNTS OF ANGIOSPERMS FROM
NEW MEXICO AND ADJACENT AREAS

DARRELL E. WARD and RICHARD SPELLENBERG
Box 30001, Biology Department
New Mexico State University
Las Cruces, NM 88003-0001

The following 124 chromosome number determinations are from flowering plants of New Mexico, southeastern Arizona and adjacent areas. These determinations are part of a continuing project to expand the cytogeographic knowledge of the region from the southern Rocky Mountains to the northern Sierra Madre Occidental. All counts in this listing are derived from chromosome configurations seen in pollen mother cells during various stages of meiosis. A count believed to be the first for a taxon is designated by (**) and a new ploidal-level report by (++) before the relevant epithet. After review of the standard indices and western floras, we find that counts listed for 2 genera, 20 species and 6 varieties are first reports. Codes for collectors are S = Richard Spellenberg and W = Darrell Ward. Cytological material was stained in Snow's hydrochloric-acid-carmin stain (Snow, 1963). Voucher specimens are deposited at NMC, and duplicates of many are at NY and RSA.

APIACEAE: Cicuta maculata L. var. (**) angustifolia Hook. n=11. NM, Lincoln Co., White Mts., 5.5 km WNW of Alto, W 81-436.

APOCYNACEAE: Apocynum androsaemifolium L. var. androsaemifolium. n=11. NM, Otero Co., Sacramento Mts., La Luz Canyon, 5 km N of Cloudcroft, W & S 87-006.

ASTERACEAE: Artemisia (**) neomexicana Greene ex Rydb. n=9. NM, Grant Co., 9 km SW of Emory Pass, W 80-017. This count was first published in Ward, 1983 as A. ludoviciana var. mexicana. The proper identification was provided by Elisabeth Bol of the University of Oklahoma.

Aster hesperius Gray var. (**) wootonii Greene. n=32. NM, Otero Co., USFS Road-63, 1.5 km S of High Rolls, W 84-032.

Baccharis brachyphylla Gray. n=9. NM, Hidalgo Co., Peloncillo Mts., US Hwy-80, 17 km S of Road Forks and IH-10, W 81-561.

Baccharis (**) thesioides H.B.K. n=9 + 3-4 supernumeraries. AZ, Cochise Co., Chiricahua Mts., Herb

- Martyr CG, 10 air km WSW of Portal, W 86-049.
- Bahia woodhousei Gray. n=12. NM, Cibola Co., 50 km NNW of Pietown, 17 km N of Catron Co. line, W 81-521.
- Brickellia betonicaefolia Gray. n=9. AZ, Cochise Co., Chiricahua Mts., CG at S Fork of Cave Cr. Canyon, W 86-008a; Turkey Cr., 11 km W of Portal, W 86-040.
- Chrysopsis villosa (Pursh) Nutt. n=9. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-514.
- Chrysothamnus greenei (Gray) Greene var. linifolius (Rydb.) H. & C. n=9. NM, Cibola Co., NM Hwy-117, 13 km SSE of Grants, W 81-503.
- Chrysothamnus nauseosus (Pall.) Britt. subsp. bigelovii (Gray) Hall. n=9. NM, McKinley Co., US Hwy-666, 51 km N of Gallup, W 81-490.
- Cirsium (**)pallidum W. & S. n=17. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-427.
- Cirsium parryi (Gray) Petrak. n=17. NM, Sacramento Mts., La Luz Canyon, USFS Road-162, W & S 87-013.
- Cirsium undulatum (Nutt.) Spreng. n=13. NM, Lincoln Co., White Mts., USFS Road-117, 2 km W of Alto, W 81-469.
- Conyza canadensis (L.) Cronq. n=9. NM, Lincoln Co., White Mts., 6 km WNW of Alto, Eagle Cr., W 81-524.
- Cosmos parviflorus (Jacq.) H.B.K. n=12. AZ, Cochise Co., Chiricahua Mts., Turkey Cr., 11 air km W of Portal, W 86-037; NM, Lincoln Co., White Mts., N fork of Eagle Cr., 6 km WNW of Alto, W 81-528.
- Erigeron divergens T. & G. 2n=27 (triploid). NM, Hidalgo Co., NM Hwy-338 highway, 1.5 km S of IH-10, W 86-068; NM, McKinley Co., NM Hwy-400, 3 km S of Ft. Wingate village, W & S 81-499; Otero Co., Sacramento Mts., US Hwy-82, 1.5 km W of High Rolls, W 81-532.
- Erigeron (**)lepidopodus (Rob. & Fern.) Nesom. n=9. MEX, Chihuahua, 32 km W of Tomochic on road to Basaseachic, S 8414.
- Erigeron platyphyllus Greene. n=9. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-419.
- Eupatorium pycnocephalum Less. n=10. AZ, Cochise Co., Chiricahua Mts., S Fork of Cave Cr., W 86-013.
- Gaillardia pinnatifida Torrey. n=17. NM, Otero Co., Sacramento Mts., 6 km S of High Rolls, USFS Road-90, W 81-543.
- Helianthella quinquenervis (Hook.) Gray. n=15. NM, Otero Co., Sacramento Mts., 5 km N of Cloudcroft, W & S 87-007.
- Hymenopappus flavescens Gray var. (**)cano-tomentosus Gray. n=17. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-516.
- Hymenopappus newberryi (Gray) Johnston. n=17. NM, Otero Co., Sacramento Mts., USFS Road-90, 10 km S of High Rolls, W & S 87-002.

- Lactuca ludoviciana (Nutt.) DC. n=17. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-445.
- Lactuca pulchella (Pursh) DC. n=9. NM, Lincoln Co., SE Ruidoso, Paradise Canyon Rd., W 81-458.
- Leucelene ericoides (Torrey) Greene. n=16. NM, Eddy Co., US Hwy-82, 3 km E of Otero Co. line, W 84-003.
- Machaeranthera asteroides (Torrey) Greene var. asteroides. n=4. Otero Co., Sacramento Mts., USFS Road-90, 10 km S of High Rolls, W & S 87-003. This collection and S 6323, reported in Ward and Spellenberg (1984), are identifiable as M. tephrodes (Gray) Greene. This has been relegated to synonymy under M. asteroides by B.L. Turner according to recent annotations of specimens.
- Machaeranthera parviflora Gray. n=4. NM, Otero Co., US Hwy-70/82, saline lake, 24 km WSW of Alamogordo, W & S 87-020.
- Machaeranthera riparia (Knuth) A. Jones. n=5. NM, Hidalgo Co., NM Hwy-338, 4.5 km S of IH-10, W 86-068; SE corner of the intersection of NM Hwy-338 and IH-10, W 86-072. One large bivalent and four smaller ones were observed as reported by Turner et al. (1975). During Anaphase I, the large bivalent was extremely late in separating. W 86-068 was of the annual form usually associated with the species. W 86-072 was a very large, sprawling, highly-branched plant.
- Machaeranthera taetina Greene. n=4. NM, Otero Co., US Hwy-70/82, saline lake, 24 km WSW of Alamogordo, W & S 87-021.
- Machaeranthera tenuis (Wats.) Turner & Horne. n=9. TX, Jeff Davis Co., Davis Mts., Madera Canyon, W 81-306.
- Pectis filipes Gray. n=12. AZ, Cochise Co., Peloncillo Mts., S Fork of Skeleton Canyon, 1.5 km W of NM-state boundary, W 81-570a.
- Perityle staurophylla (Barneby) Shinners. n=17. NM, Otero Co., Sacramento Mts., USFS Road-90, 5.5 km S of High Rolls, W 81-540a.
- Porophyllum ruderale (Jacq.) Cass. subsp. macrocephalum (DC.) R.R. Johnson. n=11. AZ, Cochise Co., Peloncillo Mts., Skeleton Canyon, 2 km W of NM-state boundary. W 81-563.
- Senecio eremophilus Richards var. macdougalii (Heller) Cronq. n=20. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-027a; NM, Lincoln Co., White Mts., 5.5 km WNW of Alto, W 81-429.
- Solidago canadensis L. var. scabra T. & G. n=27. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-440; TX, Culberson Co., Guadalupe Mts. National Park, McKittrick Canyon, W 84-029.
- Solidago missouriensis Nutt. var. fasciculata Holz. n=9. NM, Catron Co., Gila Nat. Forest, USFS Rd-

141/NM Hwy-59, 13 km WNW of Beaverhead,
Todsens 82-038.

Solidago parryi (Gray) Greene. n=9. NM, Lincoln Co.,
White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-425.

Solidago rigida L. var. humilis Porter. n=9. NM,
Lincoln Co., US Hwy-70 roadside, 7 km SW of Ruidoso,
W 81-454; Otero Co., Sacramento Mts., US Hwy-82,
8 km E of Cloudcroft, W 84-021. W 84-021 was typi-
cal of S. rigida. Collection W 81-454 has the pubes-
cence, diploidy, and ovate upper leaves of S. rigida
var. humilis. It also has 3 parallel, brown veins
on most of the phyllaries, with 5 being present on
the remainder. The inflorescence, however, resem-
bles the sympatric S. wrightii Gray var. wrightii in
being cymose with long pedicels instead of having
the tight cyme of typical S. rigida.

Solidago velutina DC. var. nevadensis (Gray) C. & J.
Taylor. n=9. NM, Otero Co., US Hwy-24, 12 km E of
Cloudcroft, W 81-461.

Solidago wrightii Gray var. adenophora Blake. n=9. NM,
Hidalgo Co., Peloncillo Mts., Skeleton Canyon,
S 6313.

Thelesperma simplicifolium Gray. n=9. NM, Otero Co.,
Tularosa Canyon, 19 km S of Mescalero, W 81-459.
Previous reports of n= 10, 11, 20 and 22 have been
reported for this taxon from stations further east
(Strother, 1983).

Viguiera longifolia (Robins.) Blake. n=8. AZ, Cochise
Co., Chiricahua Mts., S Fork of Cave Cr., W 86-011a.

Viguiera stenoloba Blake var. chihuahuanensis Butter-
wick. n=34. NM, Otero Co., Sacramento Mts., 6 km S
of High Rolls, W 81-542.

Zinnia acerosa (DC.) Gray. n=10. NM, Hidalgo Co.,
Playas Valley, 3 km S of NM Hwy-9, W 86-067.

BORAGINACEAE: Hackelia floribunda (Lehm.) I.M. John-
ston. n=12. NM, Lincoln Co., White Mts., 5.5 km
WNW of Alto, W 81-434.

Heliotropium (**) greggii Torrey. n=14. NM, Doña Ana
Co., 15 km NNE of Las Cruces, Jornada Del Muerto
Road, W 81-574.

Lithospermum (**) multiflorum Torrey. n=14. NM, Otero
Co., Sacramento Mts., USFS Road-90, 18 km S of High
Rolls, W & S 87-004.

BRASSICACEAE: Draba helleriana Greene var. (**) patens
(Heller) O.E. Schulz. n=8. NM, Lincoln Co., White
Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-426.

Thelypodopsis (**) vaseyi (S. Wats.) Rollins. n=10.
NM, Otero Co., Sacramento Mts., La Luz Canyon, USFS
RD-162, W & S 87-012.

- CAPPARACEAE: Cleome serulata Pursh. n=16. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-504.
- CARYOPHYLLACEAE: Arenaria confusa Rydb. n=20. NM, Lincoln Co., White Mts., US Hwy-70 roadside, 7 km SW of Ruidoso, W 81-451.
- Drymaria (**)tenella Gray. n=18. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-028.
- CHENOPODIACEAE: (**)Allenrolfea occidentalis (Wats.) Kuntze. n=9. NM, Otero Co., US Hwy-70/82, 5 km E of White Sands National Monument, W 81-475.
- Suaeda fruticosa (L.) Forsk. n=9. NM, Otero Co., 5 km E of White Sands National Monument, W 81-476.
- CUCURBITACEAE: (**)Echinopepon wrightii (Gray) Watson. n=12. NM, Grant Co., Black Range, Iron Cr., NM Hwy-90, W 81-558.
- FABACEAE: Astragalus (**)albulus W. & S. n=11. NM, McKinley Co., NM Hwy-400, 3 km S of Ft. Wingate village, W & S 81-494.
- Dalea filiformis Gray. n=7. AZ, Cochise Co., Basin Trail (USFS Trail-247), 11 air km W of Portal, W 86-046.
- Dalea (**)ordiae Gray. n=14. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-023; Chiricahua Mts., Turkey Cr., 11 air km W of Portal, W 86-039. Both collections of this tetraploid showed a high frequency of 8 bivalents and 3 quadrivalents during Metaphase I. Mature pollen tetrads had a 10% incidence of a fifth, highly reduced cell.
- Desmodium (**)arizonicum Watson. n=11. AZ, Cochise Co., Chiricahua Mts., CG at S Fork of Cave Cr., W 86-009.
- Desmodium (**)grahami Gray. n=11. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-025.
- Desmodium (**)procumbens (Mill.) Hitchcock. n=11. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-026.
- Desmodium (**)psilophyllum Schlecht. n=11. AZ, Cochise Co., Chiricahua Mts., CG at S Fork of Cave Cr., W 86-006.
- Lotus oroboides (H.B.K.) Ottley var. oroboides. n=7. NM, Lincoln Co., White Mts., 5.5 km WNW of Alto, W 81-447.
- Lupinus argenteus Pursh. n=24. NM, Cibola Co., 50 km NNW of Pietown, 17 km N of Catron Co. line, W & S 81-520.
- Petalospermum exile Gray. n=7. AZ, Cochise Co., Chiricahua Mts., 5 km W of Portal, W 86-020; Basin Trail (USFS Trail-247), 11 air km W of Portal, W 86-048.

Phaseolus (**) heterophyllus Willd. var. heterophyllus.
n=11. AZ, Cochise Co., Peloncillo Mts., S Fork of
Skeleton Canyon, 2 km W of NM-state boundary,
W 81-562.

HYDROPHYLLACEAE: Phacelia neomexicana Thurber var. alba
(Rydb.) Brand. n=11. NM, Lincoln Co., White Mts.,
US Hwy-70, 7 km SW of Ruidoso, W 81-450.

HYPERICACEAE: Hypericum formosum H.B.K. n=8. NM,
Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of
Alto, W 81-438.

LAMIACEAE: Monarda menthaefolia Graham. n=17. NM,
Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of
Alto, W 81-437.

Monarda punctata L. var. (**) occidentalis (Epl.) Palmer
& Steyerl. n=12. NM, Cibola Co., Grant Malpais, NM
Hwy-117, W & S 81-515.

Salvia (**) lycioides Gray. n=11 + 1 supernumerary. NM,
Otero Co., Sacramento Mts., USFS Road-90, 18 km S of
High Rolls, W & S 87-001.

LILIACEAE: Allium cernuum Roth var. (**) neomexicanum
(Rydb.) MacBr. n=7. NM, Lincoln Co., White Mts.,
Eagle Cr., 5.5 km WNW of Alto, W 81-423.

Allium cernuum Roth var. obtusum Cocker. n=7. NM,
McKinley Co., NM Hwy-400, 3 km S of Ft. Wingate
village, W & S 81-493.

Allium geyeri Watson. n=7. NM, Otero Co., US Hwy-82,
Fresnal Canyon, 1.5 km W of High Rolls, W 81-417.

Anthericum (**) torreyi Baker. n=32. NM, Lincoln Co.,
White Mts., 2 km W of Alto, W 81-464.

LOASACEAE: Mentzelia rusbyi Wooton. n=10. NM, Lincoln
Co., White Mts., N edge of Ruidoso, W 81-448.

MALVACEAE: Anoda cristata (L.) Schlecht. var. cristata.
n=30. NM, Luna Co., Cooke Range, E base of Cooke
Peak, W 81-557.

Sidalcea candida Gray var. candida. n=10. NM, Lincoln
Co., White Mts., Eagle Cr., 5.5 km WNW of Alto,
W 81-432.

Sphaeralcea angustifolia (Cav.) Don var. cuspidata
(Britt.) Gray. n=5. NM, Otero Co., S edge of High
Rolls, USFS Road-63, W 81-479.

Sphaeralcea grossulariaefolia (Hook. & Arn.) Rydb. var.
(**) pedata (Torrey) Kearney. n=10. NM, McKinley
Co., NM Hwy-400, 3 km S of Ft. Wingate village, W &
S 81-501. This contrasts with n=21 for this species
reported in Hitchcock et al. (1961, page 431).

Sphaeralcea incana Torr. var. incana. n=10. NM, Cibola Co., 13 km SSE of Grants, W & S 81-502; Luna Co., Cooke Range, at Cooke abandoned town, W & Sorenq 81-553.

Sphaeralcea subhastata Coult. var. (**)pumila (W. & S.) Kearney. n=15. NM, Lincoln Co., White Mts., NM Hwy-532, 1 km W of Alto, W 81-472; Otero Co., Sacramento Mts., Fresnal Canyon, 1.5 km W of High Rolls, US Hwy-82, W 81-533.

ONAGRACEAE: Zauschneria latifolia (Hook.) Greene. n=15. AZ, Cochise Co., Chiricahua Mts., CG at S Fork of Cave Cr., W 86-012.

POACEAE: Agrostis semiverticillata (Forsk.) C. Chr. n=14. AZ, Cochise Co., Chiricahua Mts., Herb Martyr CG, Cave Cr. Canyon, 10 km SW of Portal, W 86-056.

Blepharoneuron tricholepis (Torrey) Nash. n=8. AZ, Cochise Co., Chiricahua Mts., Crest Trail, 1.5 km S of Rustler Park Ranger Station, W 86-058.

Bromus lanatipes (Shear) Rydb. n=14. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-422.

Bromus richardsonii Link. n=14. NM, Otero Co., Sacramento Mts., La Luz Canyon, USFS Rd-162, W & S 87-014.

Digitaria sanguinalis (L.) Scop. n=18. AZ, Cochise Co., Chiricahua Mts., Herb Martyr CG, 10 km WSW of Portal, W 86-050.

Echinochloa crusgalli (L.) Beav. var. (**)mutis (Pursh) Peterm. n=27. AZ, Cochise Co., Chiricahua Mts., 5 air km W of Portal, W 86-024.

Eragrostis neomexicana Vasey. n=30. NM, Otero Co., Sacramento Mts., La Luz Canyon, USFS Road-162, W & S 87-017.

Sporobolus contractus Hitchc. n=18. NM, Cibola Co., E edge of Grant Malpais, NM Hwy-117, W & S 81-505.

Sporobolus cryptandrus (Torr.) Gray. n=19. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-510.

POLEMONIACEAE: Ipomopsis longiflora (Torr.) Grant. n=7. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-506.

Linanthastrum nutallii (Gray) Ewan subsp. nutallii. n=9. NM, Lincoln Co., US Hwy-70, 7 km SW of Ruidoso, W 81-456.

Polemonium foliosissimum Gray var. molle (Greene) Anway. n=9. NM, Otero Co., Sacramento Mts., 5 km N of Cloudcroft, W & S 87-009.

POLYGALACEAE: Monnina (**)wrightii Gray. n=10. AZ, Cochise Co., Chiricahua Mts., Basin Trail (USFS Trail-247), 11 air km W of Portal, W 86-047.

Polygala scoparioides Chodat. n=17. TX, El Paso Co., N end of Franklin Mts., 11 km E of Anthony, W 86-002a.

POLYGONACEAE: Eriogonum (**) annuum Nutt. n=20. NM, Cibola Co., Grant Malpais, NM Hwy-117, W & S 81-509.

Eriogonum jamesii Benth. var. (**) jamesii. n=20. NM, Otero Co., W edge of High Rolls, US Hwy-82, W 81-478.

Eriogonum (**) polycladon Benth. n=13. NM, Dona Ana Co., US Hwy-70/82, 1 km W of Organ, S & Soreng 6197.

PRIMULACEAE: Androsace septentrionalis Pursh var. puberulenta (Rydb.) Knuth. n=10. AZ, Cochise Co., Chiricahua Mts., Crest Trail, 1.5 km S of Rustler Park Ranger Station, W 86-059.

RANUNCULACEAE: Delphinium novomexicanum Wootton. n=8. NM, Otero Co., Sacramento Mts., La Luz Canyon, USFS Rd-162, S & W 9208.

RHAMNACEAE: Ceanothus integerrimus Hook. & Arn. n=12. AZ, Cochise Co., Chiricahua Mts., beside road to Onion Saddle (USFS Road-42), 11 air km W of Portal, W 86-044.

ROSACEAE: Potentilla norvegica L. n=35. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-431.

Potentilla (++) pennsylvanica L. n=7. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-441.

Potentilla pulcherrima Lehm. n=42. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-433.

SAXIFRAGACEAE: Heuchera parvifolia Nutt. var. parvifolia. n=7 (2n=14 + 1 supernumerary). NM, Lincoln Co., White Mts., Eagle Cr., W 81-443. In about one-fourth of the cells observed, a supernumerary chromosome was present in the metaphase plate and afterwards. It did not divide during Anaphase I, but did migrate to one anaphase pole. The supernumerary was about 1 micrometer in diameter, stained as darkly as the other chromosomes, and exhibited no sign of lagging.

Heuchera rubescens Torrey. n=7. NM, Lincoln Co., White Mts., Eagle Cr., 5.5 km WNW of Alto, W 81-442.

SCROPHULARIACEAE: Cordylanthus wrightii Gray subsp. wrightii. n=13. NM, McKinley Co., NM Hwy-400, 3 km S of Ft. Wingate village, W & S 81-497b. In the observed meiocytes, two of the bivalents were paler staining and noticeably smaller. The base number for this genus is thought to be n=14 (Chuang and

Heckard, 1986).

Mimulus cordatus Greene. n=15. AZ, Cochise Co., Chiricahua Mts., Bootlegger Trail (USFS-257), S of Rustler Park, w 86-062.

VERBENACEAE: Verbena macdougalii Heller. n=7. NM, Lincoln Co., US Hwy-70, 7 km SW of Ruidoso, W 81-452.

Acknowledgements: The identification by Almut Jones of a very difficult specimen of Aster hesperius var. wootonii was deeply appreciated. Lincoln Constance provided the determination of Cicuta maculata, and Guy Nesom identified Machaeranthera tenuis. The collections from the Chiricahua Mountains in Arizona were collected while DW was staying at the Southwestern Research Station of the American Museum of Natural History at Portal, AZ. Partial funding of this publication was provided by the Friends of the Herbarium of the New Mexico State University Foundation.

LITERATURE CITED

- Chuang, T., and L. Heckard. 1986. Systematics and evolution of Cordylanthus (Scrophulariaceae-Pediculariaceae). Syst. Bot. Monog. Vol. 10.
- Hitchcock, C., A. Cronquist, M. Ownbey and J. Thompson. 1961. Vascular plants of the Pacific Northwest. Part 3. Univ. Washington Press, Seattle. 614 pp.
- Keil, D., and D. Pinkava. 1976. Chromosome counts and taxonomic notes for Compositae from the United States and Mexico. Amer. J. Bot. 63: 1393-1403.
- Snow, R. 1963. Alcoholic hydrochloric acid-carmines as a stain for chromosomes in squash preparations. Stain Technol. 38:9-13.
- Strother, J.L. More chromosome studies in Compositae. Amer. J. Bot. 70: 1217-1224.
- Turner, B.L., J. Bacon and T. Wendt. 1975. Chromosomes and phyletic position of Aster sonorae Gray. (Asteraceae - Section Oxytripolium). Southwestern Naturalist 19: 361-364.
- Ward, D. 1983. IN: A. Löve. IOPB Report LXXX. Taxon 32:504-511.
- Ward, D., and R. Spellenberg. 1984. Chromosome counts from New Mexico and Mexico. Phytologia 56:55-60.
- Ward, D., and R. Spellenberg. 1986. Chromosome counts of angio-sperms of western North America. Phytologia 61(2): 119-125.